Amendment and Response
Applicant: Ronald A. Askeland et al.
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Title: ESTIMATING LOCAL EJECTION CHAMBER TEMPERATURE TO IMPROVE PRINTHEAD PERFORMANCE

IN THE CLAIMS

Please cancel claims 1, 2, 12, 23, 26, and 29 without prejudice.

Please add new claims 31-32.

Please amend claims 3, 6, 8, 9, 21, 22, 24, 25, 27, 28, and 30 as follows:

1. (Cancelled)

2. (Cancelled)

3. (Currently Amended) The temperature control system of claim ~~1~~ 24 wherein the controller is located on at least one of the printhead assembly and a printer associated with the printhead assembly.

4. (Previously Presented) The temperature control system of claim 25 wherein the controller reads the pulse width and pulse width calibration data from a memory located on the printhead assembly.

5. (Previously Presented) The temperature control system of claim 25 wherein the controller reads the pulse width and pulse width calibration data from a memory located on a printer associated with the printhead assembly.

6. (Currently Amended) The temperature control system of claim ~~1~~ 24 wherein the temperature sensor is an analog temperature sensor.

7. (Previously Presented) The temperature control system of claim 6 further including an analog to digital converter for generating a digital format from the analog temperature sensor.

8. (Currently Amended) The temperature control system of claim ~~1~~ 24 wherein the temperature sensor is a digital temperature sensor.

9. (Currently Amended) The temperature control system of claim ~~1~~ 24 wherein the temperature sensor includes multiple temperature sensors distributed around the printhead assembly.

10. (Previously Presented) The temperature control system of claim 4 wherein the pulse width calibration data is in the form of an equation.

11. (Previously Presented) The temperature control system of claim 4 wherein the pulse width calibration data is in a look-up table.

12. (Cancelled)

13-20. (Cancelled)

21. (Currently Amended) The method of controlling the temperature of claim ~~12~~ 30 wherein the pulse width calibration data is in the form of an equation.

22. (Currently Amended) The method of controlling the temperature of claim ~~12~~ 30 wherein the pulse width calibration data is in a look-up table.

23. (Cancelled)

24. (Currently Amended) ~~The temperature control system of claim 23~~ A printhead temperature control system, comprising:

a printhead assembly having a plurality of ejection elements;

a temperature sensor configured to generate a measured temperature of the printhead assembly;

a memory device configured to store a thermal response model of the printhead assembly and an ejection history of the ejection elements; and

a controller configured to estimate an actual temperature of the printhead assembly based on the measured temperature of the printhead assembly, the thermal response model of the printhead assembly, and the ejection history of the ejection elements,

wherein the ejection history of the ejection elements identifies whether the ejection elements have been fired and whether the ejection elements have not been fired, and

wherein the thermal response model of the printhead assembly includes a first set of parameters when the ejection elements have been fired and a second set of parameters when the ejection elements have not been fired.

25. (Currently Amended) The temperature control system of claim ~~1~~ 24 wherein the ejection elements are energizable by an electrical pulse having an amplitude and a pulse width, wherein the memory device is configured to store an optimal operating temperature of the printhead assembly, and wherein the controller is configured to adjust the pulse width based on the optimal operating temperature of the printhead assembly and the estimate of the actual temperature of the printhead assembly.

26. (Cancelled)

27. (Currently Amended) ~~The method of claim 26~~ A method of controlling a temperature of a printhead having a plurality of ejection elements, the method comprising:

sensing a current printhead operating temperature with a sensor on the printhead; and

estimating an actual printhead operating temperature based on a thermal response model of the printhead, an ejection history of the ejection elements, and the current printhead operating temperature,

wherein the ejection history of the ejection elements identifies whether the ejection elements have been fired and whether the ejection elements have not been fired, and wherein the thermal response model of the printhead includes a first set of parameters when the

ejection elements have been fired and a second set of parameters when the ejection elements have not been fired.

28. (Currently Amended) The method of claim ~~2~~ 27 further comprising:

energizing the ejection elements with an electrical pulse having an amplitude and a pulse width; and

adjusting the pulse width based on an optimal operating temperature of the printhead and the estimate of the actual printhead operating temperature.

29. (Cancelled)

30. (Currently Amended) ~~The method of controlling the temperature of claim 29~~ A method of controlling a temperature of a printhead having a plurality of ejection elements energizable by an electrical pulse having an amplitude and a pulse width, the method comprising:

obtaining current operating parameters of the printhead and a current operating temperature of the printhead;

determining an estimated actual operating temperature of the printhead based on a thermal response model of the printhead, the current operating temperature of the printhead, and the current operating parameters of the printhead, including an ejection history of the ejection elements;

calculating an adjusted pulse width based on pulse width calibration data for the printhead, the current operating parameters of the printhead, and the estimated actual operating temperature of the printhead; and

applying the adjusted pulse width to the printhead to control printhead temperature,

wherein the ejection history of the ejection elements identifies whether the ejection elements have been fired and whether the ejection elements have not been fired, and wherein the thermal response model of the printhead includes a first set of parameters when the ejection elements have been fired and a second set of parameters when the ejection elements have not been fired.

31. (New) A printhead temperature control system, comprising:

a printhead assembly having a plurality of ejection elements;

a temperature sensor configured to generate a measured temperature of the printhead assembly;

a memory device configured to store a thermal response model of the printhead assembly and an ejection history of the ejection elements; and

a controller configured to estimate an actual temperature of the printhead assembly based on the measured temperature of the printhead assembly, the thermal response model of the printhead assembly, and the ejection history of the ejection elements,

wherein the thermal response model includes a first set of parameters when the printhead assembly has been printing and a second set of parameters when the printhead assembly has not been printing.

32. (New) The temperature control system of claim 31 wherein the ejection elements are energizable by an electrical pulse having an amplitude and a pulse width, wherein the memory device is configured to store an optimal operating temperature of the printhead assembly, and wherein the controller is configured to adjust the pulse width based on the optimal operating temperature of the printhead assembly and the estimate of the actual temperature of the printhead assembly.